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Proceedings of the Central and Arctic Regional Science Advisory Process on the Identification of Conservation Objectives and Boundary Delineation for the Darnley Bay Area of Interest

December 8, 2010

Freshwater Institute
501 University Crescent
Winnipeg, MB R3T 2N6

Margaret Treble
Meeting Chairperson

Joclyn Paulic
Editor

Compte rendu du processus de consultation scientifique régional sur l'établissement d'objectifs de conservation et de limites géographiques pour la zone d'intérêt de la baie Darnley

Le 8 decembre 2010

Institut des eaux douces
501, University Crescent
Winnipeg MB R3T 2N6

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Présidente de la réunion

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March 2011 | **Mars 2011**

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

Under the Health of the Oceans Initiative, Fisheries and Oceans Canada (DFO) Science sector has been asked to provide advice in support of the identification and development of Marine Protected Areas (MPAs) following the selection of an Area of Interest (AOI). An AOI was nominated in Darnley Bay, which is located in the western Canadian Arctic within the Beaufort Sea Large Ocean Management Area (LOMA). Subsequently, an ecological overview and assessment report (EOAR) was developed for the nominated AOI. DFO Science was asked by DFO Oceans to undertake a review of the EOAR, identify and prioritize areas within the AOI which meet the criteria for marine protection under the *Oceans Act*, provide advice on boundaries for those areas and identify one or more conservation objectives for each. A science advisory meeting was held on 8 December 2010 to review the EOAR and develop science advice on potential areas for protection. Meeting participants were from DFO Science sector and Oceans program, and specialists from the Canadian Wildlife Service, Natural Resources Canada and the Fisheries Joint Management Committee. The draft EOAR was distributed prior to the meeting. During the meeting, participants discussed the best available information, and knowledge gaps related to physical and ecologial processes and species known within Darnley Bay and the surrounding marine region. On the basis of those discussions, four areas within or near Darnley Bay were identified for possible marine protection and their boundaries delineated. One or more conservation objectives were formulated for each area. The draft EOAR was revised to reflect the discussions and conclusions reached during the meeting. It was published as a Research Document.

This Proceedings report summarizes the relevant discussions and presents the key conclusions reached at the meeting. A Science Advisory Report and supporting Research Document, resulting from this advisory meeting, are published on the DFO Canadian Science Advisory Secretariat Website at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

SOMMAIRE

Dans le cadre de l'Initiative pour améliorer la santé des océans, on a demandé au secteur des Sciences de Pêches et Océans Canada (MPO) de formuler un avis à l'appui de la désignation et de la création de zones de protection marines (ZPM) à la suite du choix d'une zone d'intérêt (ZI). On a désigné une ZI dans la baie Darnley, qui est située dans l'ouest de l'Arctique canadien, à l'intérieur de la zone étendue de gestion des océans (ZEGO) de la mer de Beaufort. On a par la suite produit un rapport d'examen et d'évaluation de l'écosystème (REEE) pour la ZI désignée. Le personnel d'Océans du MPO a demandé au secteur des Sciences d'effectuer un examen du REEE, de relever les zones de la ZI qui répondent aux critères de protection marine en vertu de la *Loi sur les océans* et d'en établir l'ordre de priorité, de formuler un avis sur la délimitation de ces zones et d'établir un ou plusieurs objectifs de conservation pour chaque zone. Le 8 décembre 2010, on a tenu une réunion de consultation scientifique afin de passer en revue le REEE et d'élaborer un avis scientifique sur les zones qui pourraient faire l'objet d'une protection. Parmi les participants, mentionnons des représentants du secteur des Sciences et du programme des Océans du MPO ainsi que des experts du Service canadien de la faune, de Ressources naturelles Canada et du Comité mixte de gestion de la pêche. On a diffusé la version préliminaire du REEE avant la réunion. Pendant la réunion, les participants ont discuté de la meilleure information disponible, des lacunes dans les connaissances sur les processus physiques et écologiques et sur les espèces présentes dans la baie Darnley ainsi que dans la région marine avoisinante. À la suite de ces discussions, on a relevé quatre zones dans la baie Darnley ou situées près de celle-ci qui pouvaient faire l'objet d'une protection marine et on en a établi les limites. On a formulé un ou plusieurs objectifs de conservation pour chaque zone. L'ébauche du REEE a été révisée afin qu'elle rende compte des discussions tenues et des conclusions tirées pendant la réunion. Ce document a été publié en tant que document de recherche.

Le présent compte rendu résume les discussions tenues et présente les principales conclusions tirées pendant la réunion. Un avis scientifique ainsi que le document de recherche à l'appui découlant de cette réunion de consultation scientifique sont publiés sur le site Web du Secrétariat canadien de consultation scientifique du MPO à l'adresse : http://www.dfo-mpo.gc.ca/csas-sccs/index-fra.htm.

INTRODUCTION

In 2007, ecologically and biologically significant areas (EBSAs) were identified in the Beaufort Sea Large Ocean Management Area (LOMA) through a series of science and community workshops. Subsequently, an Area of Interest (AOI) was nominated in Darnley Bay, which includes portions of the Pearce Point and Hornaday River EBSAs. An ecological overview and assessment report (EOAR) was developed for the Darnley Bay AOI. It characterizes the ecology of the area and provides the basis for determining whether an MPA should be established within the nominated AOI. Fisheries and Oceans Canada (DFO) Science was asked by DFO Oceans to undertake a review of the EOAR, identify and prioritize areas within the AOI which meet the criteria for marine protection under Section 35 of the *Oceans Act*, provide advice on the boundaries for those areas and identify one or more conservation objectives for each.

A science advisory meeting was held on 8 December 2010. The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to review the EOAR and develop science advice on potential areas for protection. Meeting participants (Appendix 2) included DFO Science sector and Oceans program, and specialists from Environment Canada (Canadian Wildlife Service), Natural Resources Canada and the Fisheries Joint Management Committee (FJMC). The meeting was held in Winnipeg, although some participants joined the meeting via teleconference. The draft EOAR was sent to participants prior to the meeting. The meeting generally followed the agenda outlined in Appendix 3.

This Proceedings report summarizes the relevant discussions and presents the key conclusions reached during the meeting. Science advice resulting from this meeting is published in the CSAS Science Advisory Report series and the supporting technical information is published in the Research Document series.

After a round of introductions, the Chair went over the meeting objectives, agenda and anticipated outputs of the meeting.

PRESENTATIONS

OVERVIEW OF AREA OF INTEREST SITE SELECTION

Presenter: Joclyn Paulic, DFO Science

An overview of the process to identify EBSAs and select an AOI within the Beaufort Sea LOMA was provided for meeting participants. Leading up to the science advisory meeting, EBSAs were identified through a series of science and community workshops based on scientific information and local community knowledge (Paulic et al. 2009). EBSAs are used as a tool to aid and guide management decisions by identifying areas that require greater than usual protection. When funding was announced for a new MPA within the Beaufort Sea LOMA, a site selection advisory committee (SSAC) consisting of representatives from DFO, Inuvialuit Regional Corporation (IRC), Inuvialuit Game Council (IGC) and the FJMC was struck to identify and recommend an AOI. The SSAC was directed to focus the identification process on the three outlying communities (Paulatuk, Ulukhaktok and Sachs Harbour) since they had previously expressed an interest for marine protection within their respective planning areas. After a series of consultations the SSAC recommended an area that included the Pearce Point and Hornaday River EBSAs to the Beaufort Sea Regional Coordinating Committee (RCC). The Pearce Point EBSA, offshore of Cape Parry, had been identified as an EBSA for feeding and migrating species that are seen and/or harvested there on a regular basis. The Hornaday River EBSA had been identified because of its importance for Arctic Char. The recommendation for the

nominated area was approved by the RCC and a MPA Steering Committee was subsequently formed to identify the AOI within the larger identified EBSAs. Currently the nominated AOI encompasses a portion of both identified EBSAs in Darnley Bay: the western, nearshore region (5 km from shore) just west of Paulatuk north to Cape Parry and Fiji and Booth Islands. Since available scientific information for the AOI is limited and some areas outside the AOI are known to have biological significance, especially for Arctic Char, participants agreed that it did not make sense to restrict the discussion to the current AOI boundaries. Advice from this meeting was based on scientific evidence and expert opinion for the two identified EBSAs, not taking into account social, cultural or economic (SCE) interests.

The importance of a scientific review of the EOAR for both the Beaufort Sea LOMA and the AOI was highlighted. The AOI EOAR is the basis for all decisions leading to the establishment of a marine protected area (MPA), including the identification of priority areas, delineation of boundaries and development of conservation objectives. Subsequent steps taken, including the development of regulations and the design of indicators and a monitoring plan, are based on the conservation objectives.

It was noted during the presentation that Paulatuk, Ulukhaktok and Sachs Harbour identified areas important for Arctic Char and recommended them for marine protection. The communities were then told that they could only select one AOI. The original AOI that the SSAC recommended for protection was the entire coastline of Darnley Bay, however once DFO Oceans and the MPA Steering Committee took into consideration the feasibility criteria[1] for MPA designation, the size of the area was decreased. Cape Parry was also identified as a priority area since the area met three of the national MPA criteria for designation.

Some participants questioned if the boundaries of the AOI could be expanded to include the eastern side of Darnley Bay where most of the critical char habitat is known to be located. It was explained that this science advisory meeting was the opportunity to communicate that type of advice to the DFO Oceans Programs Division; it is also an opportunity for participants to provide advice on any other habitats, species or life history functions that warrant protection in Darnley Bay. The advice resulting from this meeting will provide the scientific rationale for protection of certain areas and their ecological boundaries.

SUMMARY OF MAIN FINDINGS FROM THE ECOSYSTEM OVERVIEW REPORT
Presenter: Joclyn Paulic, DFO Science

The EOAR will be published in the form of a CSAS Research Document. The purpose of this summary is for participants to discuss and advise on the main findings from each topic. In several instances, contributors have pulled together unpublished data that was collected in Darnley Bay, while in many other cases, contributors inferred the ecological and biological characteristics based on studies conducted elsewhere in the Beaufort Sea.

[1] DFO Oceans MPA Practitioners Guide Feasibility Criteria (2009):

- Federal jurisdictional authority should be clear, or a federal–provincial or Aboriginal authority–Canada agreement should be in place;
- The AOI candidate should support provincial or territorial conservation visions and priorities;
- There should be minimal conflict or displacement of other resource users (e.g., existing tenure such as oil and gas leases, title and treaty claims);
- The AOI candidate should be secure from uncontrollable threats that limit its potential effectiveness (e.g., major shipping lanes); and
- Consideration should be given to post-designation management, enforcement and monitoring, including costs.

Oceanography

The presentation began with an overview of the oceanographic properties in Darnley Bay. Much of the results were based on a preliminary analysis of raw data that had been collected in the past and from some recent research activities in the area. A sea surface temperature (SST) map of the region from July 2008 revealed that a three-day easterly wind brought cold waters to the surface along the coast near Pearce Point. This indicates the possibility of wind-driven upwellings in summer, however, the regularity and significance of this event is unknown. Mundy et al. (2009) documented evidence of upwelling along the ice bridge across the mouth of Darnley Bay in June that produced under-ice phytoplankton blooms. The ice bridge appears to be a consistent feature during the ice melt season and presumably again in the fall based on the Canadian Sea Ice Service median ice concentration charts. Using a web tide model, the tidal velocities in Darnley Bay (~ 4 $cm \cdot s^{-1}$) and around Cape Parry (~10 $cm \cdot s^{-1}$) were found to be relatively small compared to other mid-latitude velocities. Regardless, they may be sufficient enough to cause vertical mixing thereby moving nutrients to the surface at Cape Parry.

There may be a unique geological gravity anomaly located in southern Darnley Bay that could influence oceanographic properties. Based on current knowledge from the area the feature does not appear to be visible. However, information collected by Darnley Bay Resources Limited indicates the anomaly is larger than the Sudbury Basin in Ontario.

Participants discussed wind and current patterns within Amundsen Gulf and Darnley Bay. The mean circulation of water (current pattern) is not well known for Amundsen Gulf or Darnley Bay. However, the varying speed and direction of wind is likely to be the dominant influence in both areas, with this influence weakened appreciably by the formation of fast ice in winter. The inflow of rivers into Darnley Bay may favour a counter-clockwise circulation in summer under the influence of the Coriolis Effect. The direction of prevailing wind is south-easterly, with highest speed in the September – November period and a smaller peak speed during April through June. These winds drive surface water to the west, perhaps with a stronger outflow on the northern side of Amundsen Gulf than the southern. Periods of west wind caused by summer storms are known to drive water from the Mackenzie Shelf of the Beaufort eastward along the southern side of Amundsen Gulf. In August 1987, surface drifters moved under influence of a down-welling favourable wind from Cape Bathurst to Darnley Bay within four days. The alternating influences of east and west wind could conceivably move surface water in a counter-clockwise circulation around the Amundsen Gulf, although this has not been established.

It was agreed that normal patterns of surface and subsurface current for the area were important baseline information for the Research Document. Biologically important nutrients could be brought from depth to the surface near the mouth of Darnley Bay via upwelling in response to south-east wind. Participants discussed wind-aided fish migrations (e.g., Arctic Cisco) in the western Beaufort Sea and the importance of understanding wind and water driven current patterns in order to understand how they influence species distributions and movements in the region.

There are currently ten years of Hornaday River flow data available online from Environment Canada. Based on the size of Darnley Bay, these data indicate, there are significant amounts of freshwater input (2.0 - 2.5 km^3), into the bay. Participants discussed the movement of the Hornaday River plume within the bay. The river plume is likely trapped in the surface layer and pushed around by the winds. However, it is difficult to predict plume movement given the limited amount of data available and complicated topography. Arctic Char are dependent on the warm, freshened waters of the Hornaday River and the availability of prey, therefore their movements

within the bay are somewhat dependent on several meteorological and oceanographic conditions that can influence prey distribution.

Benthic Habitat

In general, the benthic environment is composed mainly of silt and clay with varying degrees of mixing. There were some differences in surface substrate composition between samples taken within the bay which were silt, and those at Cape Parry that contained more rocks and coarser material. Species abundance and richness appear to be higher at Cape Parry in comparison to samples taken from within the bay. Preliminary analysis of macrofauna indicates that species abundance/richness in Darnley Bay is similar to that of the Beaufort Shelf.

According to community members and a consultant who was working in the area in 2008 (Kavik-AXYS Inc.), kelp beds are found in Argo Bay and Wise Bay. These kelp beds appear to be uncommon within the Beaufort Sea LOMA; no other areas have been identified although kelp beds may exist in Liverpool Bay and near Sachs Harbour. The closest comparison is in Alaska at Stefansson Sound (Boulder Patch) and areas within the Canadian Eastern Arctic (e.g., Resolute, Igloolik). Kelp beds are known to be associated with unique and/or diverse benthic communities and assemblages of fishes. They may also serve as important spawning habitat for some species of fishes (e.g., Pacific Herring). The location of critical spawning habitat for marine fishes is a major data gap for the Beaufort Sea LOMA. Kelp beds are often associated with rocky bottoms so it may be possible to identify other areas using shoreline survey data from the Environment Canada Environmental Sensitivity Atlas to predict where other such areas may exist along the coastline of Darnley Bay.

Bathymetric Data

We are currently using the coarse scale General Bathymetric Chart of the Oceans (GEBCO; IOC et al. 2003). There are a few multi-beam images taken from the CCGS *Amundsen*, however there is little to no data available for waters less than 20 m in depth. The lack of bathymetric data for Darnley Bay limits our ability to assess marine habitats in this area.

Marine Mammals

Satellite tagging of Belugas has confirmed that animals migrate through Amundsen Gulf in a clockwise pattern, moving west past Cape Parry during the month of August. Residents from the local community of Paulatuk report that Belugas use Brown's Harbour, Letty Harbour and Argo Bay between late July and late September. It is unclear what they are doing when they move into Darnley Bay, but they are thought to be feeding and possibly moulting in Argo Bay. The Belugas in the area are typically smaller animals that prefer open-water and have a different foraging strategy than the larger males that prefer ice-covered waters.

A genetic study is underway to examine kinship groups within the Beaufort Sea Beluga population to determine if the animals that annually return to harvesting areas in the LOMA are from the same family. Participants discussed the possibility of using satellite images to investigate Beluga distribution and abundance in Darnley Bay. However, it was noted that this would be a very costly undertaking. Participants also discussed and agreed that based on the amount of data collected from tagged whales and the current population estimate for Eastern Beaufort Sea Belugas, the area could be frequented more often and for longer periods of time suggesting the area may be more important to the population than originally thought.

During spring surveys, Bowheads and Belugas were observed diving at the Franklin Bay ice-edge (historic data 1970s and 2008). In years of heavy pack ice, Belugas tend to be distributed throughout the pack ice; while in low pack ice years they were located along the ice edge, presumably feeding. This indicates that there may be prey aggregations under the ice-edge in spring which may also be the case along the ice edge of Darnley Bay.

Bowhead whale observations by Paulatuk community members have increased over the past ten years. In spring, the whales are known to be aggregating at the ice-edge off Cape Parry in deeper areas of Amundsen Gulf, including the outer portions of Darnley Bay. There are also small aggregations occurring along the coast near Pearce Point. These whales are presumably feeding.

There is very little information available for bearded seals in the Beaufort Sea LOMA. They are usually solitary and have a patchy distribution. Locals report sighting bearded seals on land at Bennett Point and Cape Parry.

Participants noted that ringed seals are widely distributed in Darnley Bay year-round. They utilize stable landfast ice for pupping and the ice-edges for feeding. Benoit et al. (2010) revealed that during winter ringed seals in Franklin Bay made dives of up to 230 m to feed on aggregations of Arctic Cod. Similar behaviour could be inferred for ringed seals in Darnley Bay. The section on ringed seals still needs to be drafted for the Research Document.

Polar Bears

Researchers from Environment Canada (Canadian Wildlife Service) indicated that the area north of Cape Parry, in association with the Cape Bathurst polynya, represents important habitat from late spring through early summer. Landfast ice in Darnley Bay and Franklin Bay also likely represents important habitat for females with cubs-of-the-year. Because of the lack of scientific data on Polar Bear habitat use in Darnley Bay participants suggested that traditional ecological knowledge on Polar Bear habitat use within this portion of the AOI be incorporated into the review process.

Anadromous and Marine Fish

A map containing point distributions of fishes sampled for scientific purposes in Amundsen Gulf, Franklin Bay and Darnley Bay was presented. The data were summarized from grey literature or published reports and any confirmed species present in museums but does not include any traditional knowledge (TK) or recent sampling efforts (i.e., some ArcticNet publications). This section of the Research Document is still under development.

Participants commented on the presence of Capelin in the Pearce Point area and in the stomach contents of Arctic Char. Capelin may be unique to the region, however, there is little known about the location, timing and regularity of Capelin aggregations. Collection of local knowledge of marine fishes in the region would be helpful.

Participants noted that the fishing location for Arctic Char has shifted and Paulatuk residents now prefer the Brock River over the Hornaday River. If the change in fishing location is due to reduced catches in the Hornaday this may be associated with the infilling of channels in the Hornaday River estuary. Families from Paulatuk typically go char fishing along both the east and the west coasts of Darnley Bay; in Argo Bay, Fish Lake, Hornaday and Brock Rivers and north along the coast to Pearce Point.

Another potentially unique feature of the Hornaday River is that Arctic Char over-winter in 'deep-holes' along the cut banks on the west shores at the mouth of the river. Tagged Arctic Char migrated downstream from the falls and remained in these holes over the winter season.

Marine Birds

A Migratory Bird Sanctuary (MBS) for Thick-billed Murres and Black Guillemots is located at the northern tip of Cape Parry. There are also significant numbers of sea ducks that stage in open water leads north of Cape Parry and around Canoe, Fiji and Booth Islands. The Cape Parry MBS encompasses three small areas of limestone cliffs where birds nest. Both colonies of birds are unique to the Beaufort Sea LOMA. The Canadian Wildlife Service (CWS) has identified key marine habitat for a variety of species of birds that are feeding, migrating and staging between the months of May-August. The key marine habitat boundary is identified by CWS as the area where a substantial amount of foraging activity typically occurs from the Thick-billed Murre colony (Mallory & Fontaine 2004).

Participants discussed seabird diet and the importance of the marine environment to their survival. It is hypothesized that the productivity of the marine environment off Cape Parry is one of the reasons the colonies became established on the limestone cliffs as opposed to other cliff habitat that exists in the LOMA. The nearby marine environment around Cape Parry must have sufficient prey resources to support adults and their young at the colony.

GUIDANCE ON DEVELOPING CONSERVATION OBJECTIVES
Presenter: Joclyn Paulic, DFO Science

The scientific advice framework on conservation objectives was summarized. Conservation objectives describe the key components of the ecosystem and are used to guide the MPA process by linking and setting the ecological bounds of the SCE objectives. Conservation objectives were initially developed for the LOMA within three overarching conservation goals: 1) Biodiversity, 2) Productivity, and 3) Habitat. For the MPA, we will "unpack" objectives with these three goals in mind. The MPA objectives need to be phrased in a manner to allow the development of monitoring indicators without additional unpacking. There can be more than one conservation objective for an MPA.

DISCUSSION

Participants expressed their concern with identifying conservation objectives and the environmental indicators that would be identified in the future, given the limited amount of scientific information available for Darnley Bay. Further discussion identified that there are currently few baseline datasets for this area and there are likely changes occurring in the ecosystem. Our understanding is based mainly on inference from the Beaufort Shelf. In addition, even if we were to identify indicators and monitor them we would still not be able to determine what caused the change and if the observed change was within the range of natural variability. This is of particular concern for species that have a wide range in distribution and utilize the area on a seasonal or opportunistic basis (i.e., Beluga).

In addition to the lack of data, the nominated area does not have clearly identified species or process that is in need of protection. For example, Tarium Niryutait MPA clearly identified the Beluga aggregations in the Mackenzie River estuary. There appears to be a need to fill substantial gaps in knowledge for the Darnley Bay area and it was suggested that participants

at this meeting may not be able to identify strong evidence to support selecting any areas within Darnley Bay for protection.

Participants reviewed the process by which the EBSAs were identified in Darnley Bay and although this was originally a community nomination, Science did evaluate the areas against the EBSA criteria. Concern regarding potential development and shipping was also an impetus for starting the process to develop a MPA in the area.

Through the efforts of the Paulatuk Hunter & Trapper Committee (HTC), DFO has coordinated a project to monitor harvests of Arctic Char in Darnley Bay for a number of years, and there exists significant local knowledge of fish use during summer in the community of Paulatuk. The community has identified the nearshore coastline of Darnley Bay as an important area based on their knowledge of Arctic Char summer feeding. While it might be hard to justify an MPA in Darnley Bay for marine mammals, it would not be difficult to justify marine protection for Arctic Char habitat.

The Cape Parry bird colony, the associated productive marine environment, and the kelp beds were also identified as unique and important areas which meet the national criteria for marine protection. Participants discussed the suggestion to identify all features and the associated boundaries of these features and then prioritize based on current knowledge.

IDENTIFICATION OF IMPORTANT ECOSYSTEM COMPONENTS

Oceanography

Based on the information compiled for this meeting four key findings related to the oceanography of the area were reviewed and are listed below.

1) Upwelling at Pearce Point and along the Ice Bridge: Upwelling at the ice edge and along the eastern coast of Darnley Bay at Pearce Point is event driven and has been shown to produce increased production (Canadian Ice Service Data; Mundy et al. 2009).
2) Tidal Forcing at Cape Parry: There appears to be enhanced tidal flows that may result in increased vertical mixing of nutrients and a corresponding increase in productivity; though this is speculative.
3) Connectivity of the Bay: The movement of waters from the Mackenzie Shelf to Darnley Bay were demonstrated from surface drifter data collected in 1987. The affect the movement of water has on the productivity of the region is unknown.
4) Freshwater Inputs from the Hornaday and Brock rivers: The affect of freshwater inputs on nearshore stratification and the physical environment in Darnley Bay create habitat for fishes. The seasonality, length of time that freshwater persists in the bay, the movement of water masses and the effect on production is not known. There are currently no data on freshwater inputs from the Brock River.

The highlighted features in oceanography aid in the characterization of habitat and allowed participants to discuss how these features relate to the biology of species, habitat use and distribution.

Primary production and zooplankton

There is a limited knowledge of the marine waters in Darnley Bay, but the current thinking is that this bay is not a highly productive area in general, although there may be peaks in productivity at times.

Benthic fauna

Participants who are knowledgeable in this area (macro/mega fauna) were not available for this meeting; their input will be incorporated into the Research Document and may help in the delineation of boundaries. However, there does not appear to be any unique species/assemblages known in this area.

Arctic Char

Participants discussed the definition of a "marine" protected area and the limitations associated with the protection of the freshwater component of Arctic Char life history. The CSAS guidance document (DFO 2007) suggests that the MPA would not cover the completely freshened waters but this could prompt management to take steps to create a coastal management plan. It was also suggested by a participant that if the estuary was defined below the low water mark (i.e. not including the inter-tidal zone) it could still be included in the MPA. All participants agreed that the Hornaday River estuary should be included as an important area identified for Arctic Char and was a reasonable focal point for the establishment of an MPA in Darnley Bay.

Participants discussed the 'deep-hole' features in the western portion of the Hornaday River estuary as potentially critical over-wintering habitat for Arctic Char. This is an unusual feature that participants agreed is not known to occur in any of the other western Canadian Arctic rivers. This statement was followed by considerable discussion with regards to the dynamics of the freshwater plume in Darnley Bay and its effects on the biology of Arctic Char.

Participants agreed that although there are populations of Arctic Char at the Horton and Brock rivers, they were smaller and contribute less to the overall production of Arctic Char in Darnley Bay in comparison to the Hornaday River system. In addition, one participant noted that the quality and taste of Arctic Char from the Hornaday River was richer in flavour than from other river systems in the Beaufort Sea LOMA.

Marine fishes

A point distribution map of Arctic Cod (*Boreogadus saida*) in Darnley Bay was presented. Everyone agreed that although ubiquitous to the Canadian Arctic, Arctic Cod are an ecologically significant species and the fundamental component to a well functioning Arctic ecosystem. Their presence is likely serving to support the food web either directly or indirectly. While other species, such as Capelin or Pacific Herring, have highly variable distributions and abundances within the region, it is likely that Arctic Cod are present throughout the year though not necessarily in large numbers. Until proven otherwise participants agreed we should assume they are present and relevant based on our current knowledge. Arctic Cod distribution and abundance in Darnley Bay is a distinct gap in the data that needs to be addressed.

Participants discussed the potential for important Arctic Cod habitat in Darnley Bay based on current knowledge in other regions of the Arctic. It was agreed that habitat preference is likely seasonal, for example in spring they would use the stable/semi-stable ice edges across Darnley Bay and the ice-edges in Amundsen Gulf. In winter "under-ice" habitat in Darnley Bay could be important based on findings from a study conducted in adjacent Franklin Bay that revealed large aggregations of Arctic Cod at water depths to a maximum of 230 m (Benoit et al. 2010).

Participants agreed that Arctic Cod may not be a focal point for protection in Darnley Bay but if their habitat were maintained (i.e., sea ice edge), this would in turn benefit the cod, aid in the

maintenance of ecosystem structure and potentially conserve other marine fauna using this habitat.

Participants discussed some of the other marine fish species that were captured in gill nets during the Hornaday River community monitoring program in August. Both Starry and Arctic Flounder occur in significant numbers and DFO has recently requested that the community start to take an inventory of all fish species captured during the monitoring program. It was noted that sculpins were not captured in these commercial style gill nets even though they are common in nearshore environments in summer. After a short discussion, participants determined that the absence of sculpins in the catch is likely due to the type of bottom habitat present at the monitoring sites and not the sampling gear. Sculpins prefer a mixed rocky environment while flat fishes prefer sandy habitat. It was also noted that there are occasionally Arctic Cisco present in the area but they are likely part of a small local population.

Kelp beds

Participants reviewed the known locations of kelp beds in the area and agreed that while there is no scientific evidence, they are a unique feature in the western Canadian Arctic. The literature demonstrates and supports the importance of kelp beds as potentially critical habitat for some spawning fishes and perhaps the presence of unique species and/or diverse assemblages. Participants support the creation of a conservation objective for kelp in the coastal area of Darnley Bay and recommend it be a high priority; however, there is not enough information to make it the primary focus of the MPA. Participants agreed that the presence, extent and structure of the kelp ecosystem(s) need to be investigated to confirm or support the local knowledge of kelp beds in the area.

Seabirds

The Cape Parry MBS supports a unique colony of marine birds in the western Canadian Arctic. Participants agreed that the birds rely on the marine habitat for survival and are a good indicator of the current state of the ecosystem. Marine birds can therefore be used as a proxy to monitor the state of the marine environment because they are relatively easy to sample and they are efficient samplers themselves. Participants discussed and agreed that the long term persistence of the Thick-billed Murre colony likely depends on consistently available prey to sustain both the chick and adults. Murres can be present at the colony from June to August with peak nesting in July. Thick-billed Murres can defer nesting in years with heavy ice conditions and may not attempt to nest if prey availability is low.

Participants discussed some of the other bird species that use the area near Cape Parry. Ivory and Ross's Gulls may overwinter in open water leads but not in consistently high numbers. Also, several species of waterfowl and other seabirds utilize waters off some of the smaller islands. The open water leads around Cape Parry, Booth, Canoe and Fiji islands are important for staging areas for thousands of sea ducks during spring migration; the islands are not part of the current MBS.

Participants agreed that the main focus of the Cape Parry area is essentially the habitat that supports increased productivity. This type of feature is seasonal and varies between open water habitat and the polynya/ice edge. Participants also noted that the sea ice edge would also be important habitat for some marine mammal species.

It was cautioned not to overlay seasonally transient features (polynya) and seasonally transient wildlife (Thick-billed Murres) since they may not be in the area at the same time. The formation

of the polynya prior to the arrival of the murres may be important in stimulating early season marine primary production even though it is not the feature that facilitates seabird feeding during summer. For approximately one in every three years the fast ice does not form across Amundsen Gulf and the polynyas and associated primary production occurs far to the east, near Dolphin and Union Strait and the community of Ulukhaktok. The food availability in the vicinity of Cape Parry may be different in such years.

Polar Bears

Polar Bears occur in the region but their abundance is not significant enough to merit identification as a focal point for an MPA. They would benefit from protection of the islands and marine environment around Cape Parry.

Beluga whales

New information on Beluga whale habitat use was presented. During a 2008 aerial survey numerous sightings of Belugas and Bowheads were recorded along the ice edge near the mouth of Franklin Bay. When the ice edge broke up the whales left the area. The study indicates that during years of low pack ice there are considerable aggregations of Belugas diving at the floe edge, while in years of high pack ice whales are distributed in Amundsen Gulf throughout the ice. Historic ice condition data in Franklin and Darnley bays showed variability between years within a five year study period (i.e., 1975-1979). This information indicates that Beluga could be attracted to Darnley Bay in some years. In spring, they may use the ice edge and during summer they may enter the estuaries and become accessible to the hunters from Paulatuk.

Some participants felt that Belugas use the area opportunistically, this is essentially the edge of this sub-population's distribution and there are other areas that are much more important than Darnley Bay. Other participants felt that the Belugas that enter the estuary in summer have a different feeding strategy and are possibly part of a distinct kinship group that warrants protection. Participants discussed the TK provided by Paulatuk residents about Belugas in Argo Bay, however, there were few details regarding the number sighted and their use of the area.

Participants agreed that although Argo Bay was important from the SCE perspective Beluga would not be considered the focal point for marine protection in this area. Further information and results of future research projects may reveal new information that could indicate protection or increased monitoring is needed. Participants agreed that Beluga should stay on the list as a potential for future conservation.

Bowhead whales

Bowhead whales make use of patchy aggregations of zooplankton that fluctuate in distribution and abundance as the oceanographic conditions change. The location of aggregations varies inter-annually, however, ice edges are considered to be important habitat where Bowheads feed. This has been shown using aerial survey data and satellite tag data. High numbers of Bowhead whales have been observed feeding in the central portion of Amundsen Gulf in spring. In addition, community observations and satellite tagging data indicate that the offshore of Brown's Harbour is attractive to Bowheads during the August feeding period.

Participants agreed that Bowhead whales would not be considered a conservation priority for the MPA, however, they would benefit from protection of the Cape Parry offshore marine environment.

Ringed seals

Participants discussed the preferred habitat for ringed seals and their general distribution and abundance in the Beaufort Sea region. It was agreed that there is good available habitat for ringed seals in Darnley Bay and they are important to the community but in terms of the regional population this area is not significant to the species. The ringed seal is very mobile and it was suggested that this would be a difficult species to monitor within the context of an MPA. In general, the distribution and abundance of ringed seals is driven by the availability of suitable ice habitat and food.

Bearded seals

Although Darnley Bay overall does not appear to be preferred habitat for bearded seals there are certain areas that are used along the western coastline at Bennett Point and Cape Parry. There was a short discussion about bearded seal diet. There was an interest in this species, since stomach contents often reveal large abundances of shrimp and other invertebrates. Areas of aggregation for shrimp have not been located in the Beaufort Sea LOMA. Participants agreed that there is currently very little known about bearded seal habitat and diet and further research and baseline studies are needed.

POTENTIAL PRIORITY AREAS FOR MARINE PROTECTION: BOUNDARY DELINEATION AND CONSERVATION OBJECTIVES

The discussion was started by giving some examples of conservation objectives. Participants then discussed possible conservation objectives and associated areas within Darnley Bay as well as the boundaries for each of these areas. Conclusions were based on scientific knowledge, expert opinion and TK available at this meeting.

Arctic Char is the species within Darnley Bay that had the most knowledge associated with it and would benefit from protection. Participants wanted to know the location of the overwintering 'deep-holes' used by Arctic Char in the Hornaday River estuary. They were identified on a satellite image of Darnley Bay, one in a large western channel and the other directly across the river on the eastern side. There was discussion as to how the environment within the 'deep-holes' is maintained throughout the winter. Participants also discussed and agreed that the current AOI boundary does not include the critical overwintering habitat for Arctic Char, therefore, the boundary for an MPA focused on Arctic Char would need to include the nearshore coastline of Darnley Bay from Bennett Point east to Pearce Point, including the mouth of the Hornaday and Brock Rivers.

Participants reviewed the information pertaining to seabird marine habitat use and identified the marine areas adjacent to Cape Parry as a conservation priority. It was noted that if this area were designated for marine protection it may allow for partnerships between the Canadian Wildlife Service and DFO linking the birds' habitat to marine environmental quality. Also, the Cape Parry bird colony is unique to the LOMA and if the birds were unable to maintain breeding at this location their loss would negatively affect biodiversity in this area.

Participants also discussed the fact that the marine habitat adjacent to Cape Parry includes a very productive and important polynya and sea-ice habitat that could be identified as a second conservation priority for this area. If human activity disrupts the physical integrity of the polynya and associated sea ice during winter and spring there could be implications, possibly negative, in the "pre-conditioning" of marine productivity in the area.

Participants noted that a shipping port may be planned for Darnley Bay near the community of Paulatuk which could have implications for Arctic Char and the integrity of ice during winter due to ice breaking and potential contaminant spills.

Participants identified two other priority areas, ice edges in the offshore and kelp beds.

In summary, the four areas that warrant marine protection in order of priority were:

1) the nearshore coastline of Darnley Bay from Bennett Point east to Pearce Point including the mouth of the Hornaday and Brock Rivers for protection of Arctic Char;
2) the marine environment with a 30 km radius from the Cape Parry MBS for the protection of staging sea ducks and feeding seabirds and marine mammals;
3) the Amundsen Gulf ice edge and ice bridge across Darnley Bay for the protection of biological productivity and feeding habitat; and,
4) the currently identified kelp beds in Argo Bay and Wise Bay and any others that may be present in Darnley Bay for the protection of kelp and the associated communities.

Participants discussed wording for conservation objectives and area boundaries for each of the four areas. These are outlined in the Research Document and Science Advisory Report (SAR).

Participants indicated that they needed to consider some of the discussions from the meeting and provide further comments on the documents before they were finalized.

KNOWLEDGE GAPS AND SOURCES OF UNCERTAINTY

Participants reviewed the list of knowledge gaps and sources of uncertainty that had been identified during the meeting. The SAR contains the summary of knowledge gaps and sources of uncertainty that participants discussed during the meeting, while some of the details with respect to knowledge gaps can be found in the Research Document.

The Canadian Arctic Shelf Exchange Study (CASES) and the Coastal Flaw Lead (CFL) studies should have information on productivity within the area although very little scientific information is available specifically for Darnley Bay. Traditional and local knowledge of ice ridging and patterns of recurrence around Paulatuk may be available. Participants agreed that a statement should be added to the Research Document and SAR that indicates there is limited scientific knowledge specific to Darnley Bay and there is likely more detailed local knowledge that should be considered by DFO Oceans Program in developing an MPA in this area.

CONCLUDING REMARKS

Participants were asked to submit any added information and editorial comments for the Research Document as soon as possible. All documents will be sent to participants for their review before finalizing and posting on the CSAS website. Participants were thanked for their time and efforts.

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APPENDIX 1: TERMS OF REFERENCE

TERMS OF REFERENCE

IDENTIFICATION OF CONSERVATION OBJECTIVES AND BOUNDARY DELINEATION FOR THE DARNLEY BAY AREA OF INTEREST

Central and Arctic Region - Science Advisory Meeting

December 8, 2010
Winnipeg, MB

Chair: Margaret Treble

Background

Canada's *Oceans Act* (1997) authorizes Fisheries and Oceans Canada (DFO) to provide enhanced management to areas of the oceans and coasts which are ecologically or biologically significant (DFO 2004). Under the Health of the Oceans Initiative, DFO Science sector provides advice in support of the identification and development of Marine Protected Areas (MPAs) following the selection of an Area of Interest (AOI).

In 2007, ecologically and biologically significant areas (EBSAs) were identified in the Beaufort Sea Large Ocean Management Area through a series of science and community workshops. The purpose of an EBSA was to call attention to areas that have particular ecological or biological significance to facilitate a greater-than-usual degree of risk aversion in management of activities in such areas (http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/ESR2004_006_e.pdf). In 2008, the DFO Oceans Programs Division created a Site Selection Committee to nominate another area for marine protection within the Inuvialuit Settlement Region (ISR). The nominated AOI for this process includes portions of the Pearce Point and Hornaday River EBSAs. At the time these two EBSAs were identified by community members, and acknowledged by Science. These areas were considered to be data deficient and no conservation objectives (COs) were identified. COs are science-based and defensible on objective grounds. They are intended to protect the biological and ecological components of the ecosystem from serious or irreversible harm.

The ecological overview and assessment report (EOAR) is the basis for all decisions leading to the establishment of the MPA. The purpose of the EOAR is to provide site-specific details for the AOI and to describe the interactions between human uses and the ecosystem. The report includes a focused description and analysis along with a recommendation whether to proceed to the regulatory stage in the designation process of the MPA. The EOAR should provide the following information: 1) characterize the ecology of the AOI; 2) provide the basis for a recommendation about whether to proceed with the process; 3) refine the COs of the proposed MPA; and 4) identify the regulatory and management measures necessary to achieve the objectives.

Objectives

The intent of the meeting is to complete the following objectives:

1) review the Darnley Bay EOAR;
2) identify and prioritize areas within the nominated AOI which meet the criteria for marine protection under Section 35[2] of the *Oceans Act*;
3) identify the COs of the areas; and
4) provide advice on the AOI boundaries based on the identified COs.

Expected Publications

The Regional Advisory meeting will generate a Canadian Science Advisory Secretariat (CSAS) Proceedings Report, which will summarize the discussion at the meeting and a Science Advisory Report (SAR), which will summarize the resulting advice. In addition, the working paper reviewed at the meeting, which provides support for the advice, will be published as a CSAS Research Document.

Participation

Experts from a variety of organizations will participate in the meeting including DFO, Environment Canada, Parks Canada Agency, Natural Resources Canada, academia and Paulatuk community members.

[2] **35.** (1) A marine protected area is an area of the sea that forms part of the internal waters of Canada, the territorial sea of Canada or the exclusive economic zone of Canada and has been designated under this section for special protection for one or more of the following reasons:
(*a*) the conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats;
(*b*) the conservation and protection of endangered or threatened marine species, and their habitats;
(*c*) the conservation and protection of unique habitats;
(*d*) the conservation and protection of marine areas of high biodiversity or biological productivity; and
(*e*) the conservation and protection of any other marine resource or habitat as is necessary to fulfil the mandate of the Minister.

APPENDIX 2: MEETING PARTICIPANTS

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[3] Participated via teleconference and WebEx.

APPENDIX 3: AGENDA

AGENDA

IDENTIFICATION OF CONSERVATION OBJECTIVES AND BOUNDARY DELINEATION FOR THE DARNLEY BAY AREA OF INTEREST

Central and Arctic Regional Advisory Meeting

December 8, 2010

Science/Oceans Boardroom (3-55)
Freshwater Institute
Winnipeg, MB

Chair: Margaret Treble

9:00 Welcome & Introductions - All

9:15 Meeting Objectives - Margaret

9:30 Overview of Area of Interest Site Selection – Joclyn

9:45 Summary of Main Findings from the Ecosystem Overview Report – Joclyn

10:15 Guidance on Developing Conservation Objectives - Joclyn

10:30 – 10:45 Coffee

10:45 Identification of Areas Valued by Science for Marine Protection – All

12:00 – 1:00 Lunch

1:00 Boundary Delineation and Identification of Conservation Objectives for each Priority Area – All

2:45 – 3:00 Coffee

3:00 Identification of Knowledge Gaps/Sources of Uncertainty, Recommended Research, Summary of Advice

3:30 Concluding Remarks

4:00 Meeting Adjourns